

Scanning high-traffic roads unmanned

Monitoring the roadways of Singapore



■ Tritech Engineering & Testing (S) Pte Ltd

■ Instruments & Software

Leica Nova MS60 MultiStation plus Leica GeoMoS monitoring software v6 and later.

■ Challenge

Setting a real-time wireless monitoring system without disturbing the traffic flow.

■ Solution

Tritech was able to set up an Automatic Road Monitoring System (ARMS) covering a two-kilometres critical stretch to monitor the road surface with a fully automated monitoring system on a real-time basis.

■ Benefits

- Wireless deliver of results soon after the completion of each measurement epoch
- The automatic scanning ability of the system enabled quick delivery of deformation information
- Ability to add defined areas to the measurement cycle
- Accuracy and reliability
- Quick interpretation of monitoring data
- Correct remedial decision making

The Singapore Land Transport Authority's (LTA) motto is We Keep Your World Moving. The organisation had committed to it with the construction of Mass Rapid Transit (MRT) System – Thomson-East Coast Line (TEL), which enhances rail connectivity cutting across from North to South corridors of the city. The new MRT line will greatly enhance the accessibility to the Central Business District and Marina Bay area.

Significantly improving travel time for commuters, the construction of TEL includes 43 kilometres of underground tunnel from Woodlands North Station to Sungei Bedok Station. With 4.5 km of tunnels underneath the dual three-lane heavy traffic Seletar Expressway (SLE), monitoring is of paramount importance where the contractor is to ensure negligible road deformation or disturbance that will affect the traffic flow.

The engineering firm Tritech Engineering & Testing (S) Pte Ltd was contracted to monitor the road surface with a fully automated monitoring system on a real-time basis. To provide this service, due to critical circumstances and high stringent monitoring requirement, Tritech initiated with Leica Geosystems' monitoring solutions.

Laser scanning and total station in one

Using the Leica Nova MS60 MultiStation plus Leica GeoMoS monitoring software v6 and later, Tritech was able to set up an Automatic Road Monitoring System (ARMS) covering a two-kilometres critical stretch of the SLE affected by drilling of the Tunnel Boring Machines (TBM) underneath. The essential laser scanning functionality of the Leica Geosystems MultiStation combined with reflectorless and prism measurements came to the rescue, as prisms installation on the road, which is prone to destruction by passing vehicles, was not an option for this project.

"With the MS60 MultiStation, we were able to setup the ARMS, enhancing productivity as an unmanned measuring system," said Dr. Tor Yam Khoon, registered surveyor with Tritech Engineering & Testing (S) Pte. Ltd. "The system also serves as an effective measuring system delivering the results wirelessly soon after the completion of a measurement epoch."

The automatic scanning ability of the system enabled quick delivery of deformation information. With GeoMoS image assisted scan area definition feature, the firm was able



to add the defined areas to the measurement cycle. For the firm, this combined solution helped enhance:

- Accuracy and reliability;
- Quick interpretation of monitoring data; and
- Correct remedial decision making.

“Leica Nova MS60 is a good hybrid of total station and laser scanner useful in deformation monitoring of points using glass prisms and surfaces using new Leica GeoMoS n.Vec Technology. In this project of road surface monitoring, successful application of the n.Vec Technology to horizontal surfaces is well demonstrated,” said Dr. Tor. “It is definitely better to derive the vector of deformation from a scan patch of at least 500 readings rather than from a single reflectorless reading.”

The data of the eight MultiStations used on the project was collated in Tritech's proprietary automated structured monitoring system. The automatic monitoring system, with ability to measure at four hourly cycles, seven days a week, of the MultiStation and GeoMoS translated into major cost savings in labour.

Data was collected from MultiStations set up at the road shoulder on a 4-m-high observation platform at the middle of four rows of patches of road surface at 25 m apart. These four scan patches were defined in rows crossing the road over the white lane markings.

These 16 regular scan patches are monitored at regular intervals. Between each 25-m regular monitoring zone there were also defined with “standby” scan patches at 5 m apart. These standby scan patches will be added to the monitoring scheme for automatic monitoring cycles whenever there is a planned or unplanned cutter head intervention. While the above MultiStation is in active monitoring, another one will be setup ahead and ready to go when the TBM enters its monitoring zone.

Support from abroad

For such a precise setup, there were initial challenges. Leica Geosystems staff in Singapore worked diligently

with support staff in Switzerland to quickly diagnose the setup issues and effectively resolve them.

“When there was a need to change the MultiStation in the midst of the monitoring campaign, there were no adverse effects to the project due to a timely and effective response by Leica Geosystems technical support,” said Dr. Tor.

Monitoring solutions by Leica Geosystems support LTA to fulfill its promise and keep the world moving wherever heavy construction projects are underway.



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